AUTOMOTIVE INDUSTRY

ADOPTING CLOUD INNOVATION PLATFORMS

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Cloud Opportunities for Automotive

The Automotive Industry is Facing Disruption

The Automotive industry is undergoing a major transformation with the evolution to electric, connected, autonomous vehicles (ECAV). This shift has introduced a significant influx of innovative startups including many from outside of the traditional automaker community.

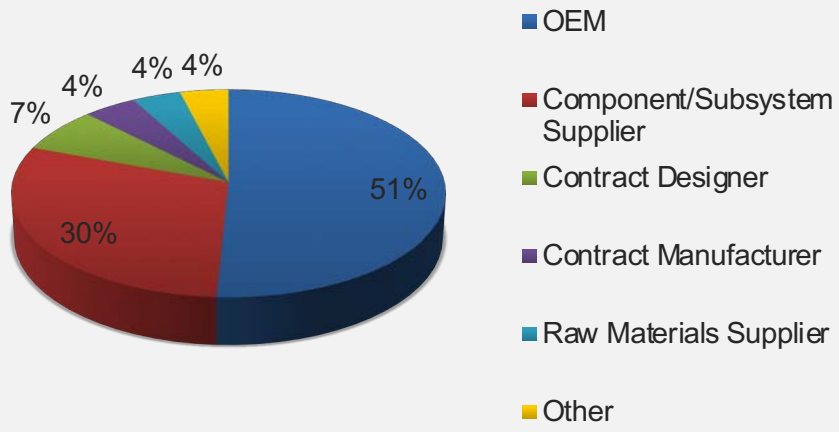
Product innovation, engineering, and manufacturing software are the tools of the trade needed to help Automotive companies innovate in these dynamic times. They can help today's OEMs and suppliers remain competitive so they can take advantage of this market disruption instead of becoming a victim of it.

Auto Industry Adopting Cloud Solutions

Another significant trend across industries is the adoption of cloud solutions. The cloud offers significant business, implementation, and operational benefits. Unfortunately, Automotive companies have historically been forced to make tradeoffs between the highly capable, integrated solutions – the Product Innovation Platform (PIP) – and the cloud. Now, PIPs are available with cloud deployments, offering the best of both worlds.

Survey of Cloud Adoption in the Auto Industry

We conducted a survey to find out how Automotive manufacturers are approaching the cloud PIP opportunity. We gathered over 250 survey responses from manufacturing and engineering services firms, and took a closer look at approximately 100 of them in the Automotive industry.



Automotive Respondents by Supply Chain Role

Product Innovation Platforms

Product Innovation Platform (PIP)

The survey defined Product Innovation and Manufacturing Software as software used to support the product lifecycle including:

- Computer Aided Design (CAD)
- Application Lifecycle Management (ALM)
- Electronic Design Automation (EDA)
- Computer Aided Machining (CAM)
- Simulation / Computer Aided Engineering (CAE)
- Product Data Management (PDM)
- Product Lifecycle Management (PLM)
- Manufacturing Execution Systems) / Manufacturing Operations Management (MES / MOM)
- Product Analytics
- Other Related Solutions

Evolution of Product Innovation Platforms

Before we explore the evolution to the cloud, it's important to understand how PIP solutions have evolved. Engineering solutions have enabled companies to design products with unprecedented levels of innovation. They've advanced to model and simulate new materials, advanced manufacturing methods, systems, and other characteristics to more accurately predict product behavior.

These engineering tools are integrated with data and process management solutions that support products, processes, and programs. These PLM tools have expanded to support a broader view of the product and support a wider range of processes ranging from ideation to launch.

Needs Expand for the Digital Enterprise

The digital transformation demands more. Solutions must support a more integrated approach, enable data-driven design, and support model-based systems engineering. They need to support digital continuity where each engineering discipline contributes their design into a comprehensive, cohesive model. They must enable real-time, secure collaboration across domains and the supply chain whenever and wherever needed.

The PIP creates a comprehensive digital thread, supports a cohesive digital twin, and breaks the paradigm of disparate, file-based systems. And it's now available on the cloud.

Succeeding in the Automotive Industry

The Industry Demands Product Excellence

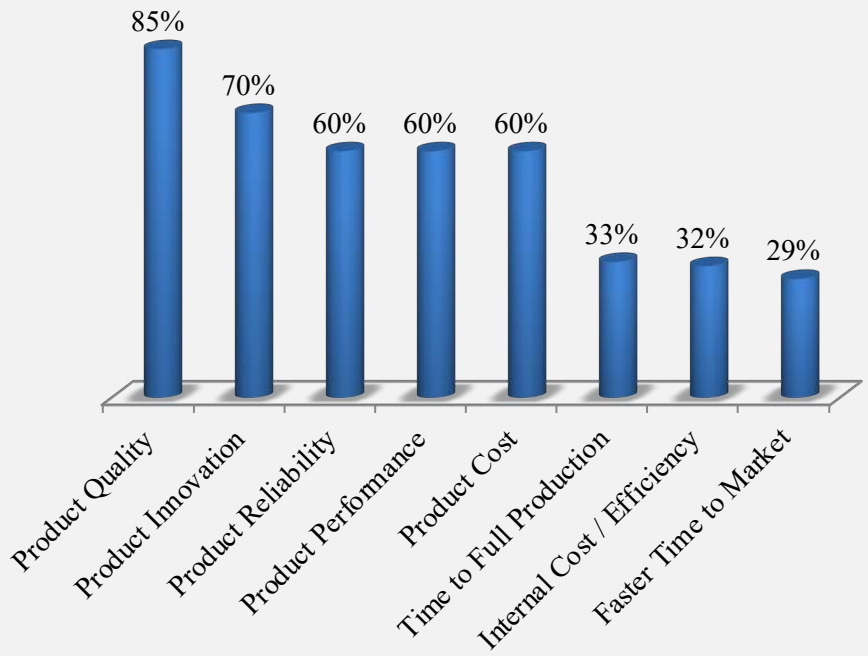
Ask people in the Automotive industry what leads to success and you'll hear that product quality has a major impact. As you might expect, survey respondents report product quality as a profitability and success driver more frequently than any other factor.

But innovation, reported as a profitability driver more frequently by Automotive companies than any other industry in our survey, isn't far behind. Perhaps this isn't surprising given the major changes facing the industry.

The top success factors – quality, innovation, reliability, performance, and cost – are all related to product excellence. But today's dynamic market also demands agility. In fact, OEMs were almost twice as likely as suppliers to report time-to-market as a critical success driver.

The PIP Delivers Product Excellence and Agility

Our research shows that an effective PIP can help improve all of these factors. These platforms, incorporating engineering tools and PLM capabilities, are proven to drive better product development



Most Important Factors to Automotive Industry Success & Profitability

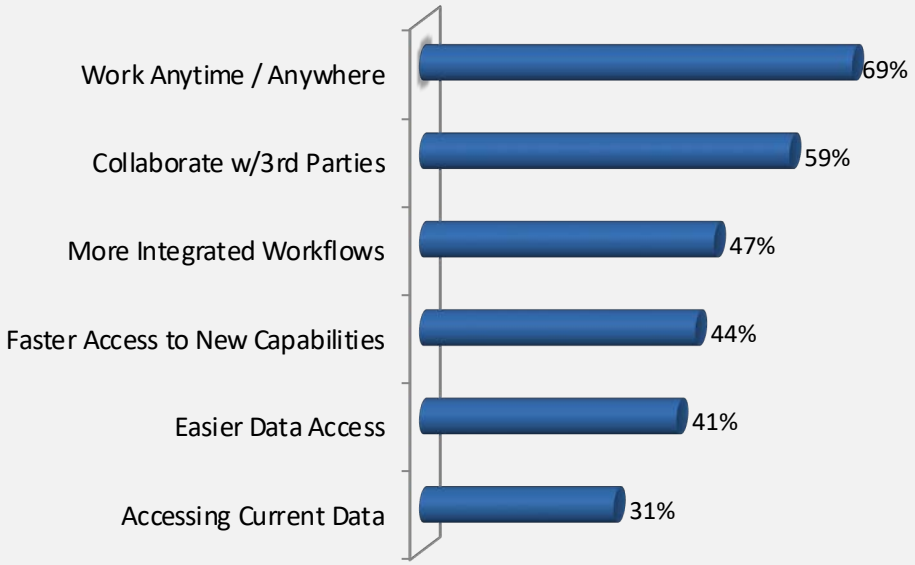
results. The cloud is reducing the barriers to these PIP solutions and provides benefits in multiple dimensions, including affordability, flexibility, and agility. We explore these further in the survey.

Business Benefits of the Cloud

Cloud Software Provides Multi-Dimensional Benefits

Why are other companies using the cloud? Cloud software provides benefits in three dimensions:

- Business
- Implementation
- Operational



Business Benefits of Cloud for PIP in Automotive

The survey investigated each of these separately, starting with business-related benefits Automotive companies receive, or expect to receive, from the use of cloud software for PIP. These are the factors that help them more directly achieve the drivers of profitability - quality, innovation, reliability, performance, and product cost.

Cloud Enables to Working Anytime, Anywhere

The most commonly reported business benefit is the flexibility to work anytime / anywhere, reported by two-thirds of participants. This is followed by ease of collaboration. This capability, along with the ability to have more integrated workflows as reported by about one-half of companies, allows OEMs and the supply chain to work together more efficiently and effectively. This is particularly important for Automotive companies given the global nature of their business, the need to be agile, and the integrated nature of the automotive value chain.

Automotive companies also pointed out the value of faster access to new capabilities, helping them get more value from their applications. The cloud gives companies flexibility in the capabilities they adopt and accelerates time to value.

Implementation Benefits of the Cloud

Automotive Values Faster Time to Value

The implementation and adoption experience for cloud solutions is typically very different than with traditional solutions, offering some significant advantages. The Automotive industry has already enjoyed these benefits in other types of solutions.

Many companies initially consider cloud solutions in order to save money. Affordability is an important factor in any industry. But cost is actually slightly less commonly mentioned as a benefit than faster time to implement. The cloud can save money, but it also helps companies be more agile, getting their solutions up and running faster. Faster implementations helps them achieve the intended business impacts of the applications – improving quality, innovation, reliability, performance, and product cost to drive company success – more rapidly.

Other Benefits

Other benefits mentioned include lower hardware costs and reduced IT needs. Each of these can provide additional savings. It's also interesting to note that reduced IT needs gives companies the flexibility to implement solutions faster because they don't have to wait for internal resource availability.

Implementation Benefits of Cloud for PIP in Automotive

Automotive Companies Open to Cloud

Cloud Adoption is Growing

Manufacturers and suppliers across industries have begun to adopt cloud solutions. Our research finds that an increasing number of companies are transitioning to the cloud in order to take advantage of significant benefits, including:

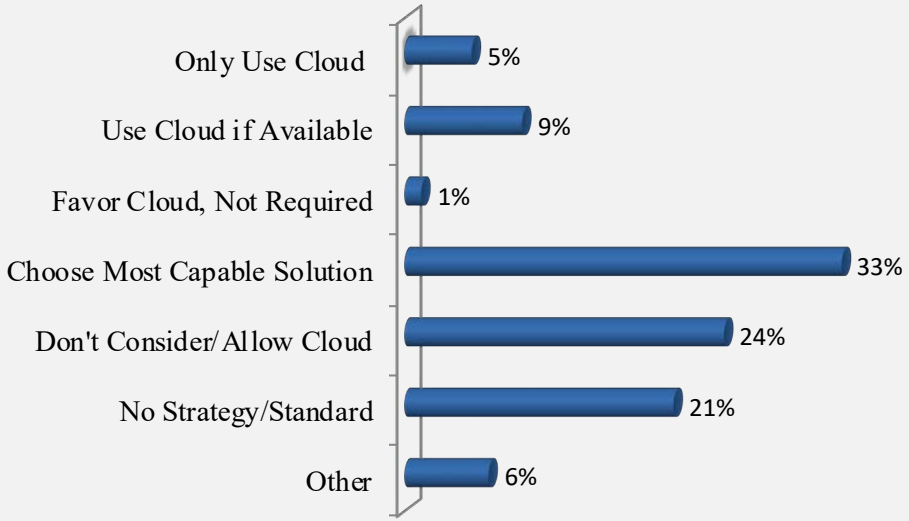
- Cost reduction
- Reduced IT resource needs
- Agility
- Scalability
- Flexibility
- Ability to work anytime, anywhere
- Rapid deployment and time to benefit / ROI
- Lower implementation risk
- Shifting capital investments to expenses

Automotive Companies are Open to the Cloud

Survey results show that the majority of Automotive companies are open to using cloud-based solutions. In fact, a small percentage actually favors or uses the cloud unless no other software is available. The most common approach in the Automotive industry, however, is to choose the *most capable* solution regardless of whether it's in the cloud.

It appears that most companies are not using the cloud as their *primary* software selection criteria. However, our experience shows that newer companies such as ECAV startups appear to be more likely to opt for cloud solutions (although the survey did not collect data to identify these innovative startups).

A number of companies surveyed say they don't consider or allow cloud, and others report that they don't have a strategy. But the cloud is an option for many, at least for some solutions, and the Automotive industry is more in favor of using cloud software than manufacturing industries in general.



Automotive Company Cloud Strategy for IT Solutions

Operational Benefits of the Cloud

Cloud Solutions offer Ongoing Benefits

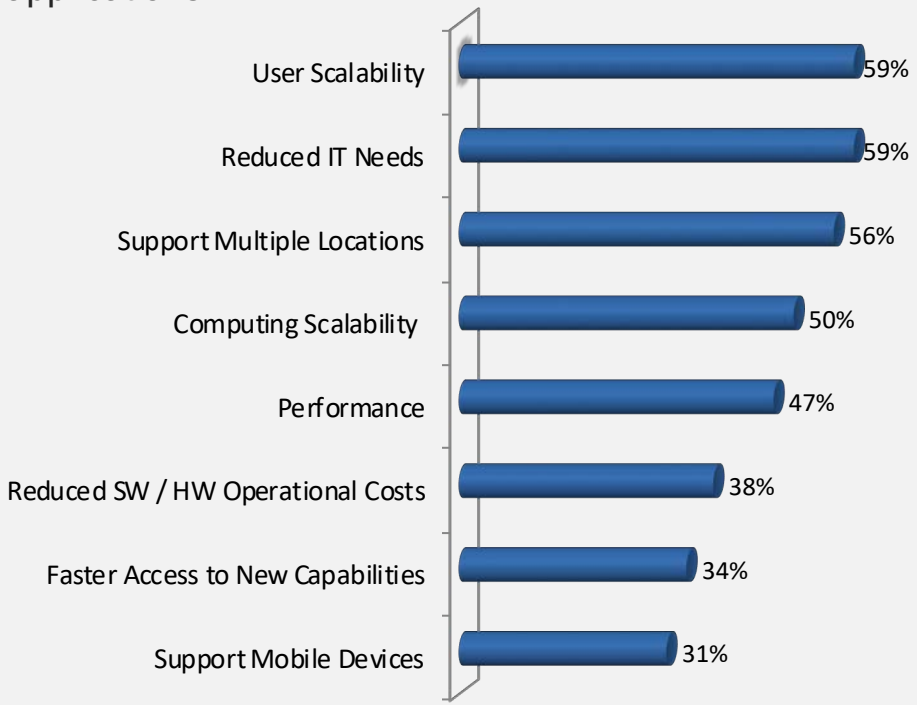
Beyond implementation benefits, there are ongoing operational benefits available from cloud deployments. The flexibility to scale user counts is the most frequently reported benefit, and one-half report computing scalability as an advantage. This kind of agility is particularly valuable for program-oriented companies and shifting demands for designing today's vehicles, including ECAV.

In addition, companies across industries report cost- and resource-related operational benefits. Over one-half cite reduced IT needs and well over one-third cite reduced software / hardware operational costs, making PIP more accessible and affordable.

Cloud Benefits Improve the Business, not Just IT

Ease of supporting multiple locations is reported by over one-half of participants. This can be a significant benefit for companies with global footprints that must support multiple sites. In addition, about one-third mention ease of supporting mobile devices. These results highlight the fact that the cloud makes accessing solutions easier, helping companies take advantage of their applications to improve the business. These factors also enable easier collaboration that can help drive the quality, innovation, reliability, performance, and cost improvements that automotive companies seek.

Lastly, it's an interesting note that about one-third observe that the cloud helps them get faster access to new capabilities - again helping companies be more nimble and get greater value from their applications.

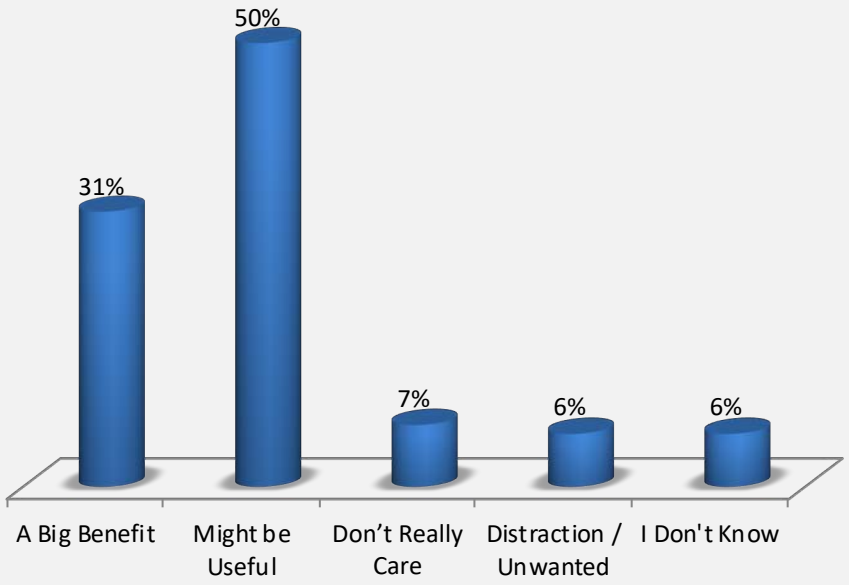


Operational Benefits of Cloud for PIP in Automotive

Value-Added Services in the Context of Innovation Tasks

Transitioning to the Cloud Opens Opportunities

One of the unique benefits of cloud solutions is the ability for the software vendor to provide links to services beyond the capabilities of the software. For example, an engineer working on a program could be offered help with their design task, sources to find capacity for an advanced manufacturing process, or a service to gather data from the supply chain on their behalf.



Value of Links to Services to Help with Current Task

Automotive Companies Value New Services

Automotive companies have a very positive view on the value of services that could help them with their current task. The vast majority say these services might be useful or a big benefit, while very few share indifference or a belief that it would be distracting.

The Cloud Provides Targeted Services

Cloud software can provide targeted help because it's aware of the function that users are performing and can provide tailored offers. It can also dynamically link to the right sources of assistance in a marketplace format, to help bring people together.

Finding help where it's easy for people to connect via the Internet when they need something can be much more expedient than a typical search and procurement process. This is another area that can help companies deliver the quality, innovation, reliability, performance, and cost improvements they need to succeed.

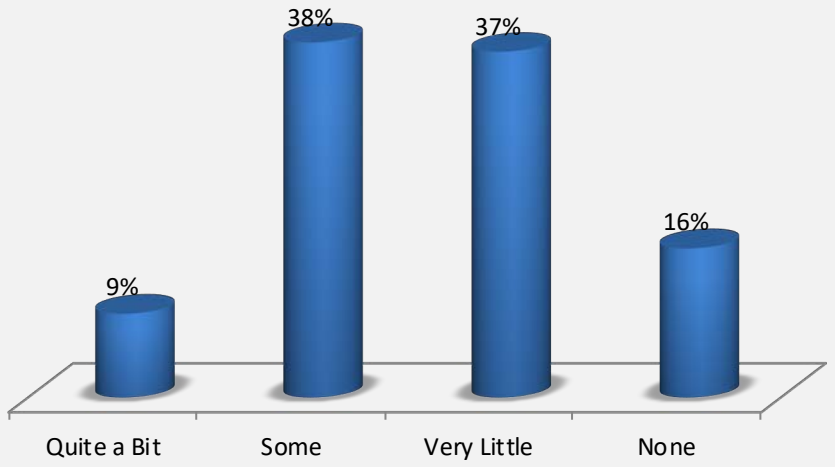
PIP Capabilities and Cloud no longer Require a Major Tradeoff

Mature PIP is now Available on the Cloud

As seen earlier, the cloud offers benefits along multiple dimensions that help companies reduce cost and risk, while providing the tools they need to succeed. Despite the advantages of a cloud deployment, companies have traditionally had to choose between full-featured systems and cloud solutions. Fortunately, Automotive companies no longer have to sacrifice the capabilities they need to innovate and drive quality because they are available in cloud PIP solutions.

Automotive Demands Capabilities and Cloud

The majority of Automotive companies say software capabilities are more important than taking advantage of cloud-specific benefits. Over one-half of Automotive companies say they're willing to give up "very little" or no software capability to use cloud software. A significant number say they won't compromise software capabilities at all in order to gain the benefits available from the cloud. Although about one-third are willing to give up "some" features, less than 10% said they would give up "quite a bit" of functionality for the cloud.



Automotive Willingness to Trade Functionality for Cloud Benefits

Mature Cloud PIP is now Available for Automotive

We believe taking this "software first" approach is the right priority for Automotive companies, because software capabilities provide the benefits of the Product Innovation Platform, including the highest success and profitability factors – quality, innovation, reliability, performance, and product cost. Now, Automotive companies can leverage robust PIP capabilities on the cloud.

Challenges Faced with Cloud Solutions

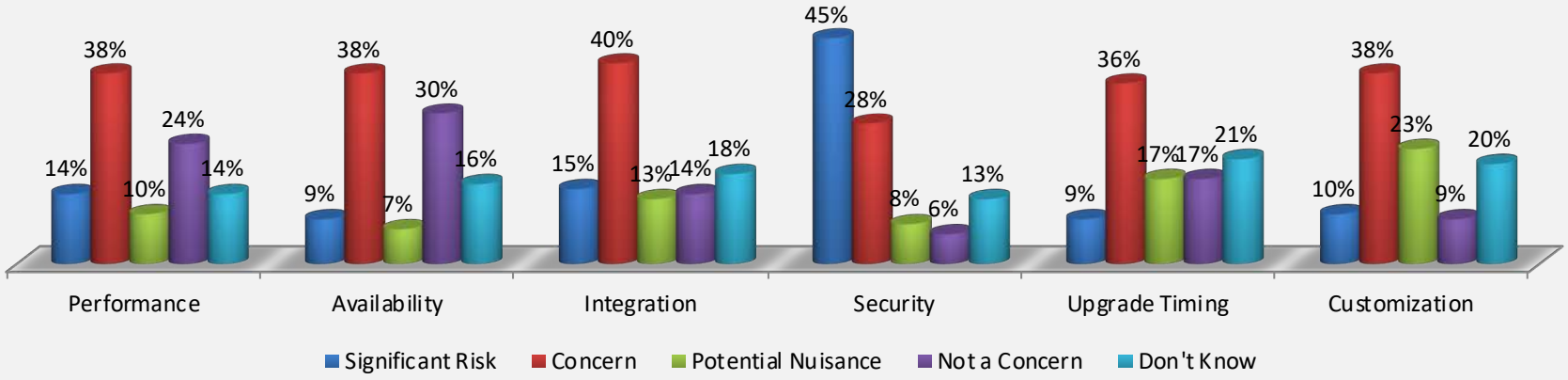
Cloud Solutions Address Security Concerns

There are clearly challenges that have to be addressed with cloud computing, but there has been significant progress. For example, just less than one-half of Automotive companies still perceive security as a "significant risk." Security is an important issue, of course, and one that requires attention regardless of whether a solution is deployed on the cloud or in a more traditional setting. Ironically, many companies including innovative startups are moving to the cloud to *reduce* security risk. They believe cloud solutions are more secure because cloud providers can leverage more dedicated security personnel and processes due to economies of scale.

Other Concerns

There are other concerns as well, but none that were reported as a significant risk by more than 15% of respondents. Companies should still pay attention to these needs and consider including key performance criteria in Service Level Agreements (SLAs) that incent providers to perform in these areas.

Automotive companies adopting the cloud will likely have to adjust their approach to upgrades, integration, and customization to work with their deployment option. But these solutions are well known as cloud experience across multiple domains has become commonplace.



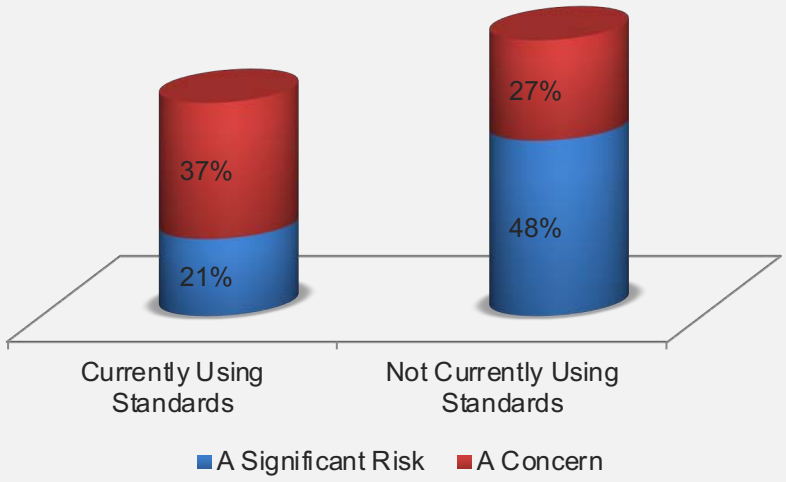
Challenges Faced (or Expected to Face) with Cloud PIP in Automotive

An Opportunity for Improvement – Standards and Audits

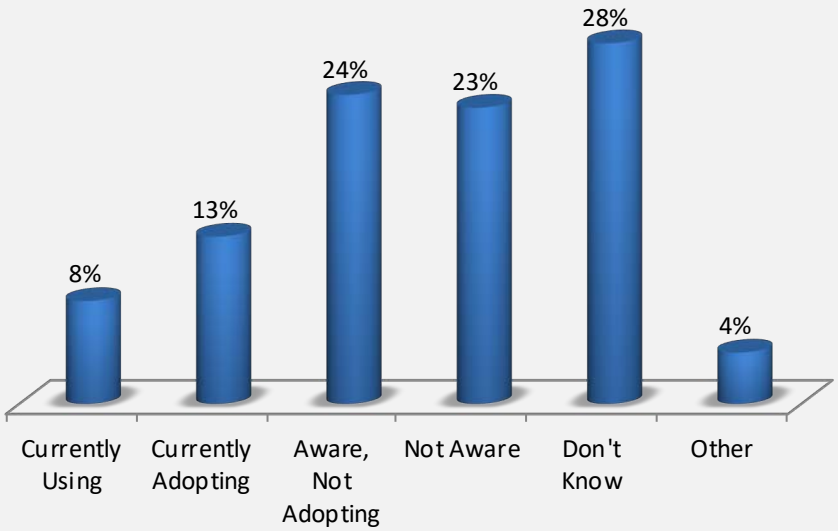
Standards and Audits Reduce Security Risk

One of the ways that companies can mitigate cloud-oriented risks in the previous chart is through the use of standards and formal audit processes. In fact, manufacturers across industries who currently use cloud standards and audit processes are over 50% less likely to consider security a "significant risk," although the majority still say it's at least a "concern."

Perhaps not surprisingly, the largest challenge Automotive companies face with the cloud, or expect to face, is security. But when asked about cloud standards and audit processes to ensure application performance and security, it appears that most Automotive companies aren't adopting them.



Perception of Security Risk by Use of Standards



Automotive Awareness of Cloud Standards and Audit Processes

Lack of Awareness of Standards and Audits

About one-quarter of respondents say their company is unaware of cloud standards and audits. About another one-quarter are aware but not adopting them. Over another one-quarter say they don't know if their company is aware of them. Implementing standards and audits is a clear opportunity for education and improvement that can help mitigate security risk.

Conclusions

The Cloud Opportunity is Compelling

Cloud solutions offer benefits along implementation, operational, and business dimensions. They provide companies the flexibility and agility they need to compete in today's changing Automotive market as old and new players alike try to capitalize on the transition to electric, autonomous vehicles.

Companies are not willing to trade off the PIP features that directly impact their success drivers – quality, innovation, reliability, performance, and product cost.

Cloud Computing without Tradeoffs

With the right cloud solution Automotive companies don't have to choose between capabilities and the cloud. They can leverage the functionality they need to compete and gain value from them faster than previously possible.

Automotive companies face a number of challenges in order to leverage the benefits of the cloud, including security, which should be addressed through SLAs, standards, and audit procedures. It's important to understand, though, that in many ways cloud deployments actually help with these challenges by offering shared services with dedicated specialists.

Cloud Adoption in Automotive will Accelerate

We see cloud PIP adoption accelerating in the Automotive industry, providing compelling benefits. We expect to see cloud solutions become a primary option as manufacturers seek to compete with innovative, new companies in new categories like ECAV.

Recommendations

Recommendations and Next Steps

Today's highly capable solutions offer the power of mature PIP capabilities along with cloud benefits, providing the flexibility and affordability that makes advanced features available to Automotive companies of all sizes.

Based on this research and our experience, we recommend that Automotive companies:

- Focus on quality and innovation to drive success and profitability
- Leverage a Product Innovation Platform (PIP) to help them develop innovative, high quality products with high performance, great reliability, and lower cost
- Adopt cloud solutions to enable anytime, anywhere access to capabilities
- Reduce implementation cost and risk while increasing flexibility and agility with the cloud
- Achieve faster time to benefit and adoption of new capabilities through cloud deployments
- Adopt cloud standards and audit procedures to mitigate security risk
- Implement Service Level Agreements (SLAs) to further reduce risk

About the Research

Data Gathering

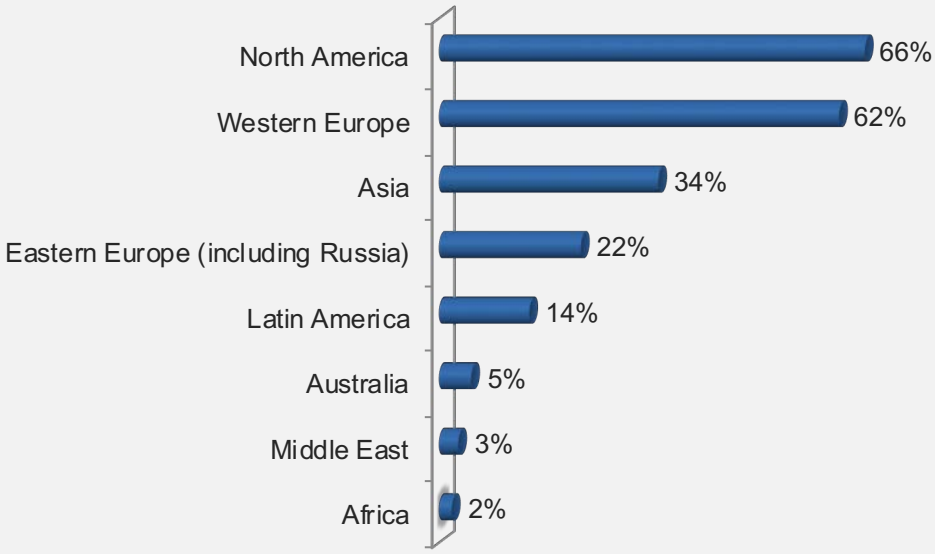
Tech-Clarity gathered and analyzed over 300 responses to a web-based survey on the use of cloud software. Survey responses were gathered by direct e-mail, social media, and online postings by Tech-Clarity and Dassault Systèmes. Of those, 254 were manufacturers or engineering firms (primarily excluding consultants, software vendors, and academia) of which 100 serve the Automotive Industry.

Demographics

The respondents represented a mix of company sizes, including 19% from smaller companies (less than $250 million), 13% between $250 million and $1 billion, 13% between $1 billion and $5 billion, and 26% greater than $5billion. 29% did not disclose their company size. Company sizes were reported in US dollar equivalent.

The respondents were comprised of over about two-thirds (63%) individual contributors, more than one-quarter (30%) manager or director level, 3% who indicate they are VP or executive levels, and 4% other roles.

Of the respondents, 52% were in engineering or design roles (including industrial / manufacturing engineering), 15% were in Information Technology (IT), 13% were analysts / simulation experts, and the remainder were from a variety of organizations including Program Management, Service, Manufacturing, Sales, Quality, and General Management. The companies were primarily OEMs (51%), with 30% component/t



Automotive Respondents Industries Served

subsystem suppliers, 7% part suppliers, 4% contract designers, 4% contract manufacturers, and 4% others.

The respondents reported doing business globally, with the about two-thirds of companies doing business in the North America (66%), about the same amount doing business in Western Europe (62%), 34% doing business in the Asia-Pacific regions, 22% in Eastern Europe, 14% in Latin America, 5% in Australia, 3% in the Middle East, and 2% in Africa. Note that the numbers total greater than 100% because companies reported doing business in multiple geographies.

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Automotive Industry Adopting Cloud Innovation Platforms

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About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries. He has a broad background including roles in industry, management consulting, the software industry, and research.

Jim's experience spans enterprise applications including PLM, ERP, quality management, service lifecycle management, manufacturing, supply chain management, and more. Jim is passionate about improving product innovation, product development, and engineering performance through digitalization and the intelligent use of software technology.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere he can engage with people with a passion to improve business performance through software technology.